

# **Djin Fu Dong in Tengchong – the longest lava tube cave in China**

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## **Abstract:**

During late autumn of 2011 was carried out the 3-rd Chinese – Bulgarian expedition in Yunnan Province – South West China. During the expedition were mapped 10 caves with a total length of the galleries above 4854 m. Among them was studied Djin Fu Dong Cave located in Tengchong volcano area. The work described the cave as the longest one lava tube cave in China – 742.1; Depth: 94.1 (-24.3); +69.8 m.

Key words: pseudokarst, lava tube cave, exploration, Tengchong volcano area, China,

## **Резиме:**

У касну јесен 2011 године извршена је 3-ћа Кинески - Бугарски експедиција у провинцији Јунан - Југозападна Кина. Током експедиције су мапирани 10 пећина са укупном дужином од 4854 м изнад галеријама. Међу њима је студирао Дјин фу донг пећина се налази у вулканском Тенгцхонг површину. Рад је описао пећину као најдужи пећини лаве цеви у Кини – дужина 742.1 м ; Глубина: 94.1 (-24.3); +69.8 м

Key words: pseudokarst, lava tube cave, exploration, Tengchong volcano area, China,

## **Introduction**

From 20 October to 10 November 2011 was carried out the 3-rd Chinese – Bulgarian expedition in Yunnan Province – South West China. The Bulgarian team was composed by Alexey Zhalov - Caving Club "Helictit" Sofia – Leader ; Alexander Stoev - Caving Club "Puldin" - Plovdiv ; Boyan Petrov - National Museum of Natural History ; Kamen Bonev - Caving Club "Vertilend" - Sofia ; Konstantin Stoilov - Student Caving Club "Academic" – Sofia. The group included a Greek speleologist Lambros Makrostergios chairman of the Cave Club of Karditsa town.

The Chinese side was composed by Zhang Fan – caver and Deputy Director of the Institute of Geography of Yunnan Province; Professor Liu Hong – hydrogeologist , Wang Jian and So Shu Xuan.

Within 20 days, 12 of which fieldwork, the expedition worked in two different areas about 400 km far from each other . Ten days were devoted to work in the Baoshan district in particular in the territory of Golingoshan National Nature Reserve, stretches along the China Myanmar border. About that time, six horizontal and 2 vertical caves were explored. The expedition worked also in area about 60 km from Kunming where longest caves of the expedition was mapped (Fig.1) :

Yenze Dong (Swallow cave) length 1514, depth -95 m and Da Shi Dong (Big rock cave) length 1394 and depth 39.30 (-22.6m / +16.7). (Zhalov, 2011)

During the expedition were mapped 10 caves with a total length of the galleries above 4854 m. B. Petrov explored all objects from biospeleological point of view, respectively, had collected a considerable zoological material. He carried out research on the species composition of bats in all visited and explored caves.

## **China's volcanoes and volcano cave exploration in the country**

There are about fifteen volcanic centers in China that have been active in the Holocene (i.e., the last 10,000 years) ( Liu, 1999, 2000) (Fig.2) . In a number of these centers basaltic volcanism has

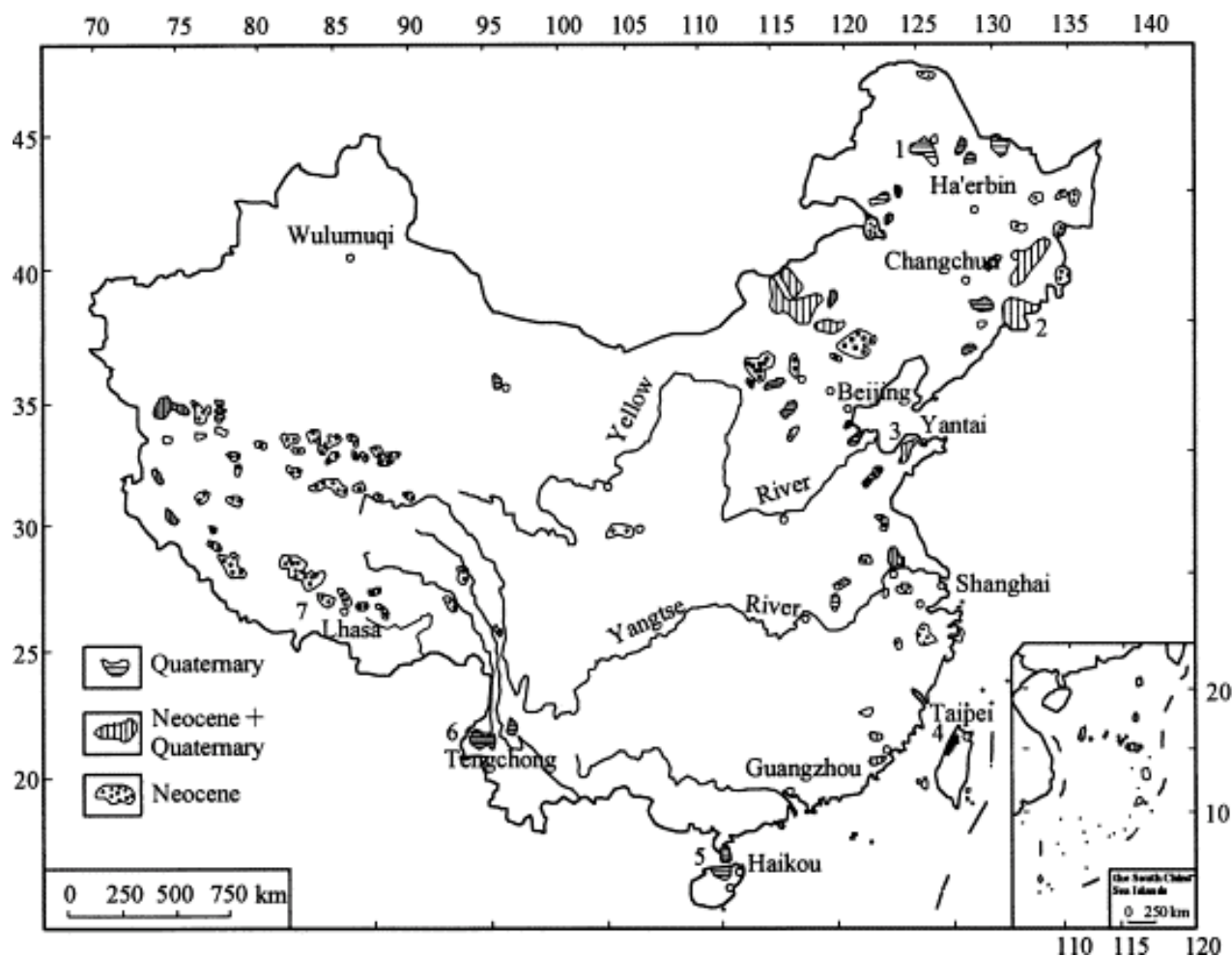


Fig.2 The distribution of the volcanoes on the territory of China

emplaced extensive lava flow fields, some of which contain evidence of lava caves. Up to date the cave exploration in China is focused in karst terrain's so, the study of the lava areas is very poor. For example in the list of the Worlds longest lava tubes compiled by Bob Gulden (<http://www.caverbob.com>) did not consist any Chinese cave. As much as the cave exploration in volcano areas exist, lava caves are known in the Wudalianchi and Jingpo Hu volcanic fields in northern China's Heilongjiang province, and in the Leiqiong volcanic field in Guangdong and Hainan provinces. (Wood & Haiyan, 2010 ). According the same authors the Underground Ice Cave situated at Wudalianchi volcanic field and especially in Loaeishan volcano area in northern Heilongjiang Province "may be the longest lava cave so far known in China (accurate mapping of caves at Jingpo Hu or Hainan Island may prove that some may be longer)". The total length of the cave is 515 m and the lava age is dated as 0.512 Ma <sup>1</sup>.

#### **The vulcanizm in West China and Tengchong volcanic field**

The volcanism in West China is a result of the collision between the Indian and Eurasian continental plates. (Fig.1) It caused deep subduction of the Indian plate beneath the Tibetan plateau which give rise to hundreds of volcano clusters in the Xinjiang (Tianshan and Turfan volcano groups), Tibet (Kunlun volcano group) and Yunnan (Tenchong volcano district ) provinces. Up to now there is not any written information for existence of lava cave.

<sup>1</sup> **Ma** (for **megaannum**), is a unit of time equal to one million ( $10^6$ ) years.

During the joint Chinese – Bulgarian expedition we worked close to the Tengchong volcano field and have the chance to make the first exploration of lava tube cave in this area.

The Tengchong volcanic district is located in southern China near the border with Burma (Myanmar). (Fig.3). Tens of volcanoes and ca 9000 km<sup>2</sup> volcanic rock, mainly formed in Quaternary, are located in the Tengchong basin in the north of Teng-Liang graben. The Tengchong area contains 3 main volcanoes of Holocene age, Dayingshan, Maanshan, and possibly Heikongshan, plus 65 older volcanoes and cones. Major volcanic rocks are basalt, dacite welded tuff, basaltic trachyandesite and trachyandesite. All of them belong to a high-potassium calc-alkaline volcanic suite. Volcanic eruptions in this region can be roughly divided into at least four stages or swarms: late Miocene–Pliocene basalt and olivine-basalt volcanic rocks (5.5–4.0 and 3.8–0.9Ma) and Pleistocene acid rocks (0.8–0.1Ma); late Pleistocene–Holocene basalts and intermediate-acid rocks such as andesites (0.1– 0.01Ma) (Mu et al., 1987)( Ji, 1998) ( Li et al., 1999) Wang et al., 1999).

The chemistry analyse of the rocks show that from Pliocene–Pleistocene to Holocene, K<sub>2</sub>O content increases in the volcanic rocks from 1.5% to 3.65%, but MgO content decreases from 5.91% to 3.04% (Fan et al.,1999). The Tengchong volcanic component has high Al<sub>2</sub>O<sub>3</sub> and K<sub>2</sub>O, but low TiO<sub>2</sub>. On the diagram of K<sub>2</sub>O–SiO<sub>2</sub>, it belongs to high-potassium basalt and andesite, as well, in the Log –Log diagram, it drops into the island-arc domain (Zhao& Chen, 1992). Nd–Sr isotopic and micro-element analysis indicates that the main-series rocks are sourced from metasomatic mantle eclogite and pyrolite (Zhu et al., 1983). Basalts and andesitic basalts are characterized by high <sup>87</sup>Sr/<sup>86</sup>Sr ratio (0.7057–0.7081), low  $\epsilon_{Nd}$  values ( $\epsilon_{1.1}$  to  $\epsilon_{5.7}$ ), and particularly high  $^{208}\text{Pb}/^{206}\text{Pb}$  ratios (1.08–1.12) (Chen et al., 2002).

### **Djin Fu Dong Lava Tube Cave**

Djin Dong is a lava tube cave, formed by Pleistocene basaltic-andesitic lava flow with age  $0.21 \pm 0.12$  Ma . It is located 5.6 km W-NW from Tengchong town and 0,350 km NE from stone kibble factory, located in (Teng Chong Xian neighborhood) on the right side of the provincial road № 317. The entrance is situated at alt. 1642 m in the middle of the vegetable field 1.2 km west from the massif of a proto volcano. WGS Coordinates: N25.03170 E98.43969 (Fig.4)

The main direction of the cave development is W – NE, so the gallery followed the way of the lava, coming up from the volcano. The entrance is elliptic (6.5 x 4.5 m) and vertical. After a drop of 2.5 m the cave branches into two directions E-NE, where the passage is going upward and W - which development is downwards. The length of the low grade passage is 210 m and its depth is – 24.3 m. The scandent branch is 521.10 m long with a depth of + 69.8. The main form of the gallery is oval (Fig.5) , but in some places becomes triangle (Fig.6) with dimensions in the range from 2-5 m width to 1.5 m – 6 m high. The floor of the whole cave is covered by basalt blocks, filmed by thick layer of mud and guano. Stalactites made of lava dripped from ceiling. (Fig.7).A lot of them are located in the entrance part of the cave. All of them are small, average length 3 cm. These are formed when the secondary lava flowing into the cave is suddenly cooled.

The water slightly enriched in CO<sub>2</sub> dribble from some fractures in the ceiling, form calcite speleothemes. (Fig.8). Probably they are as a result from solution of surficial deposits probably of sand. The calcite speleothemes in the cave includes flowstones, centimetric stalactite embryos , stalagmites, minisinters . It is wet and hot (temperature in the scandent passage is 15,3°C and in downwards one is 1-2°C lower. Total length: 742.1; Depth: 94.1 (-24.3); +69.8 m. (Fig.9).

### **Biospeleological studies**

Boyan Petrov from National Museum of Natural History explored all objects from biospeleological point of view, respectively, had collected a considerable zoological material. He carried out research on the species composition of bats in all visited and explored caves. Preliminary investigation of the collected material showed that it includes a number of probable undescribed troglobites and troglaphiles. Generic and even the family identification of many specimens are still pending examination by taxonomists.

#### **Vertebrata**

Rhinolophus cf. Stheno~ 11 ind., 1 female FA=44.0 mm. Probably the second find in Chine. (Fig.10)

#### **Invertebrate**

Araneae: 16 ind., 3 species, 1 troglobite?

Opiliones: Cyphophthalmi - 1 ind., troglobite?  
 Opiliones: Phalangidae- 1 ind.  
 Chilopoda: Scutigerae - 3 ind., 1 species, (Fig.11)  
 Collembola: 4-5 ind., 1 species  
 Coleoptera: Carabidae- 1 ind., not a cave dweller.  
 Coleoptera: Pselaphidae- 1 ind.  
 Coleoptera: Staphilinidae- 14 ind. (2 species)  
 Coleoptera: Family indet. - 1 ind., length about 3-4 mm  
 Orthoptera: Aemodogryllinae- 7 ind., > 100 observed at many places in the cave.

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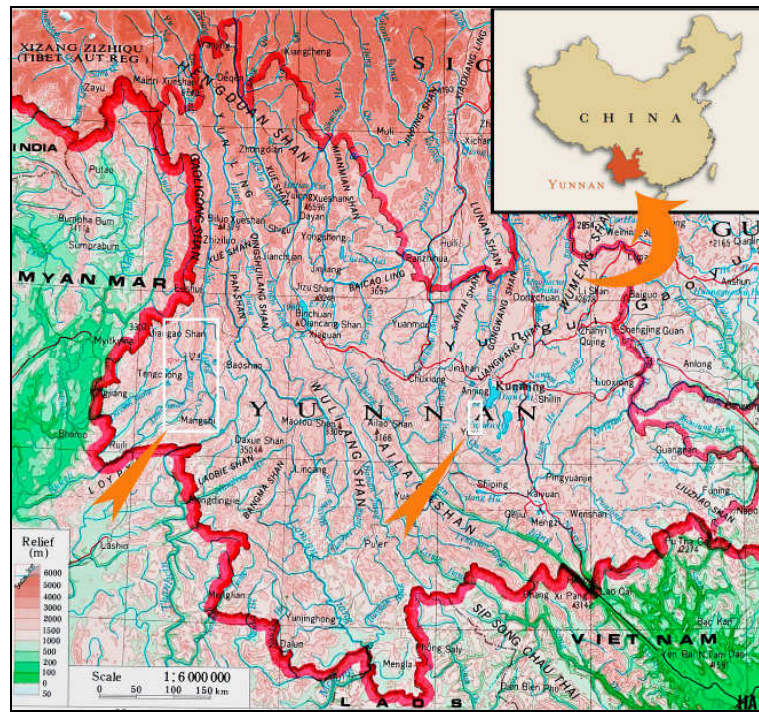
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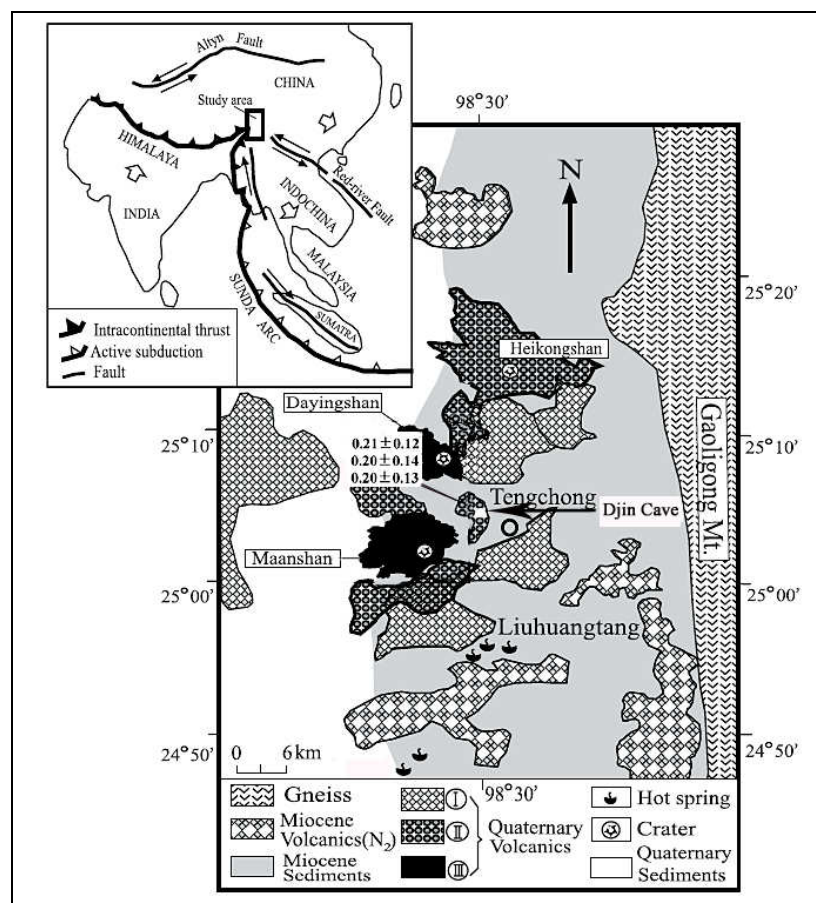
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ext under Fig.1: Location of the explored areas from the Golingongshan'2011 speleo expedition



Text under Fig.3 : Spreading of Tengchong volcano rocks. The location of the cave is given in the context of the K-Ar age (Ma) of the rock. (after Wang et.all, 2006 – modified by Zhalov, A)



Text under Fig.4: Location of the Djin Dong Lava Tube Cave



Fig.5: Typical cross section of the cave (Photos: C.Stoilov)





Fig.7. Lava stalactites in the cave ceiling (Photo: A.Zhalov)



Fig.8: Calcite stalactites in the sailing.

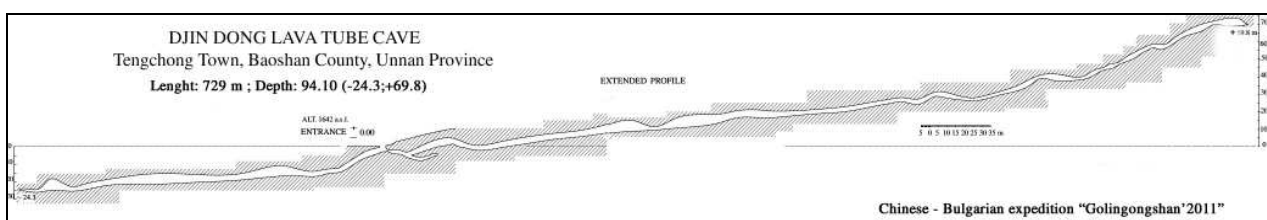


Fig.9 The map of the cave